Micro Autonomous Systems and Technology (MAST) Collaborative Technology Alliance:

Introduction to Technical Elements

Dr. Joseph Mait
Sensors and Electron Devices

August 15, 2006

Micro Autonomous Systems and Technology

- Microsystem Mechanics
- Processing for Autonomous Operation
- Microelectronics
- Platform Integration

Lead and Centers are competed independently, but overlap and integration between areas drives research.

Proposals should convey a vision for their research area and should consider two questions:

What do I offer to other Principal Members?
What do I require from other Principal Members?

Crosscutting Example

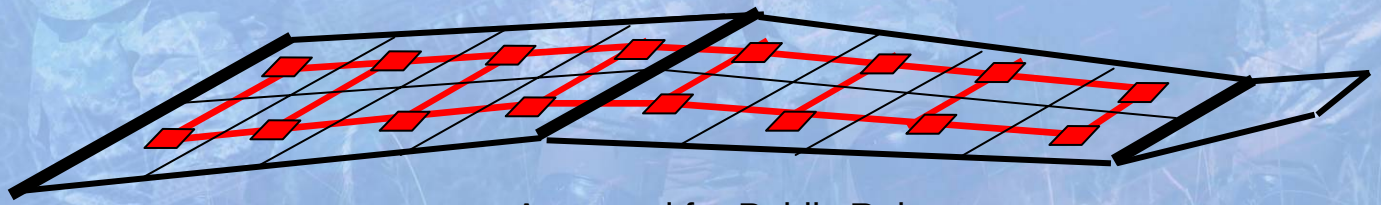
Scenario 2 Challenge:

Autonomous stable flight & navigation in gusty wind

Potential solution: flapping wing with active surface control

- Energy-efficient and gust-tolerant wing design
- Structural energy storage and distributed energy conversion
- Chemical-to-linear force actuators
- Integrated sensing, processing, and actuation for active control
- Embedded devices

  e.g., sensing, processing, actuation, interconnects, energy storage



Integration Issues

- **Integration and experimentation are the keystone for generating empirical data, providing feedback to other Principal Members, and insuring the design process is iterative**
- **Radical design and engineering methodologies are envisioned in which system-level performance is emphasized over the optimization of individual functions**

The Principal Member for Integration
has primary responsibility for
articulating and executing
a vision on cross-Consortium integration.

Example Research Topics

Micro Autonomous Systems and Technology

Microsystem Mechanics

- Platform stability & control
- Low Reynolds number aerodynamics
- Bio-inspired sub-systems
- Propulsion and linear actuation
- .
- .
- .

Processing for Autonomous Operation

- Autonomous navigation and control
- Efficient information extraction and utilization
- Dynamic collaborative processing
- Cross-layer communications and network design
- .
- .
- .

Microelectronics

- 3D materials and circuit architectures
- Sensors and actuators for platform and payload
- Smart, multifunctional materials
- Low power devices and small electric power management
- .
- .
- .

Platform Integration

- Microsystem architectures, modeling, and design tools
- Experimentation and analysis
- Sub-system interactions
- Multi-functional packaging
- .
- .
- .

Conveying a vision

- Proposals should convey a clear vision for achieving capabilities referenced in the three scenarios
- Proposals should address near-, mid-, and long-term objectives in a few areas
- Challenges are not limited to example topics presented